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(54) AN OIL FILTER TO INTRODUCE ANTI-WEAR ADDITIVES INTO ENGINE LUBRICATING SYSTEM

ÖLFILTER ZUM EINBRINGEN VON VERSCHLEISSCHUTZZUSÄTZEN IN EIN MOTORSCHMIERSYSTEM

FILTRE A HUILE POUR INTRODUIRE DES ADDITIFS ANTI-USURE DANS UN SYSTEME DE LUBRIFICATION DE MOTEUR

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Description

Background of the Invention

1. Field of the Invention

[0001] This invention relates to an internal combustion engine lubricating system and more particularly to an oil filter for releasing anti-wear additives, such as polytetrafluoroethyline, into the lubricating system.

2 Description of Prior Art

[0002] The use of polytetrafluoroethyline (PTFE) as a lubricant has been well recognized in industry for many years More recently a number of products containing PTFE have been introduced into the market place for use as additives in motor oils to reduce wear and friction. U.S. Patent Nos. 3,933,656 titled "Lubricating Oil with Fluorocarbon Additive" and 4,888,122 titled "Engine Oil Additive Dry Lubricant Powder" are exemplary of engine oil additive prior art.

[0003] There are several products commercially available containing PTFE for blending in motor oil Some trade names of PTFE additive products are Slick 50, T-Plus, and Valvoline VM8. The typical method to introduce PTFE into the engine lubricating system is during a normal oil change to replace one quart of a standard oil product with one quart of a PTFE additive product. The PTFE additive product is dispersed into the engine in the same manner as standard motor oil.

[0004] U.S. Patent 5,209,842 titled "Oil Enhancing Multifunction Filter" describes an oil filter to introduce PTFE into an internal combustion engine lubricating system. The filter uses a time release of agglomerated PTFE particles.

Summary of the Invention

[0005] The present invention as defined in the independant claims teaches a unique method of introducing a colloidal suspension of PTFE into the lubricating system of an internal combustion engine from the lubricating system filter. The colloidal suspension comprises PTFE particles of less than 2 micrometers in size suspended in petroleum oil. A specific quantity of PTFE colloidal suspension is dispensed into the outlet port of a spin on oil filter. The PTFE colloidal suspension then flows through the filters center tube holes and lockseam notch into contact with the filter media which is capable of wicking. The colloidal dispersion of PTFE in oil, when dispensed in contact with the filter media, wicks into the filter media providing a mechanism to hold the dispersion within the intricacies of the filter media fibers The colloidal suspension remains well dispersed and at the original particle size within the interstices of the filter media Within the void volume of the filter media the PTFE colloidal suspension is retained by the capillary forces of the filter media pore structure and will not readily leak out. However, when the spin-on filter containing the PTFE colloidal suspension is installed on an internal combustion engine and the engine is started the lubricating system oil flows through the filter and the colloidal suspension is immediately washed out of the filter and introduced into the lubricating system.

Brief Description of Drawings

[0006] For a better understanding of the invention reference may be had to the preferred embodiments exemplary of the inventions shown in the accompanying drawings in which:

FIG. 1 is a side sectional view of a spin-on oil filter being impregnated with a PTFE colloidal suspension according to the present invention;
FIG. 2 is a top view of the oil filter shown in FIG. 1;
FIG. 3 is a side sectional view of the oil filter of FIG. 1 showing the PTFE colloidal suspension absorbed into the filter media; and,
FIG. 4 is an enlarged view of the filter media showing the randomly oriented fibers with various pore sizes and voids

Detailed Description of the Preferred Embodiments

[0007] The present invention can be practiced with typical spin-on full flow type oil filters which are well known in the art. These spin-on oil filters normally have a cylindrical shape with inlet ports and an outlet port on the same end. The outlet flow path is through a center opening connected to a center tube. The inlet ports are disposed around the outlet port. A filter media is positioned in the flow path between the inlet ports and the outlet. The spin-on filter is mechanically attached to and engine and various gaskets and seals are provided to prevent leaks and unwanted oil flow paths.

[0008] Referring now to the drawings and FIGS. 1 and 2 in particular there is shown an improved oil filter 10 being impregnated with a PTFE colloidal suspension 12 according to the teaching of the present invention. According to the present invention a colloidal suspension with PTFE particles of less than 2 microns is suspended within the filter media 26 of filter 10 and is immediately released into the engine lubricating system as the oil passes through the filter 10 at first engine start up. The PTFE bonds to metal creating a lasting, micro-thin coating to prevent potential metal to metal contact during start up.

[0009] Spin-on oil filter 10 is used to filter out abrasive and sludge contaminants generated during operation of the engine. Filter 10 is cylindrical shaped and has an outer cover 28 and an end with an outlet port 14 and oil inlets 15. When installed filter 10 is attached to an engine with an oil flow path into the inlets 15, through a filter media 26 which is capable of wicking, and out

through outlet port 14. The typical filter media 26 used in spin-on oil filter 10 is constructed of various blends of cellulose, glass and synthetic fibers including one or all of the aforementioned fibers, bonded with a synthetic resin. The filter paper or media 26 is manufactured in such a way that the fibers are randomly oriented, as shown in Figure 4, forming a tortuous path of void volume with various pore sizes. The thickness of filter paper media 26 typically ranges from 0,00508 to 0,0152 m (.020 to .060 inches).

[0010] Within the void volume of the filter media 26 the PTFE colloidal suspension liquid is retained by the capillary forces of the fiber pore structure. The capillary forces are relatively weak, supporting only the mass of the colloidal suspension liquid itself While the capillary forces are strong enough to prevent the PTFE colloidal suspension liquid from leaking out, if lubricating oil is forced through the filter media 26 containing the colloidal suspension, the PTFE colloidal suspension will be completely washed out of the media pore structure and be displaced by the flowing lubricating oil. If a spin-on oil filter media 26 contains a colloidal suspension of PTFE particles of less than 2 micrometers in diameter retained within the media pore structure, the PTFE particles are completely released when oil flows through the filter 10.

[0011] Various methods can be used to manufacture the spin-on oil filter 10 containing the PTFE colloidal suspension 12. The preferred method is to dispense the PTFE colloidal suspension into the outlet port 14 of the filter with the filter 20 positioned vertically and outlet port 14 at the top. The PTFE colloidal suspension will initially fill a portion of the volume defined by the centertube 18 and the retainer 16, as shown in FIG. 1. As the level of the PTFE colloidal suspension rises in the filter centertube 18 it begins to flow through the centertube holes 20 and centertube notches 24 into contact with the filter media 26. The filter media 26 fabric is folded many times in a convoluted shape around the centertube 18. The convoluted shape creates a large surface area of fabric which can contact the PTFE colloidal suspension. The capillary forces acting between the filter media 26 and the PTFE colloidal suspension 12 cause the PTFE colloidal suspension to be drawn into the filter media 26. The filter media 26 is constructed of cellulose and synthetic fibers randomly formed into a fibrous porous fabric approximately 0.00101 m (0.040 inches) thick. The fabric has a void volume of approximately 80% formed by the layering and separation of fibers within the fabric A fluid substance has the opportunity to be retained within this void volume. The amount of PTFE colloidal suspension that can be retained by the filter media 26 is proportional to the total void volume of media and varies dependent on total media volume. For example: With a total media surface area of 0.0645 m^2 (100 inches squared) and a media thickness of 0.00101 m (0.040 inches) the total volume encompassing the filter media 26 is 65.5 cm^3 (4 cubic inches). If the void volume of the filter media is 80% the available volume to retain a fluid substance such as a PTFE colloidal suspension is 52.4 cm^3 (3.2 cubic inches).

[0012] Because the capillary forces are greater than the forces of gravity acting on the colloidal suspension 12 the colloidal suspension 12 will saturate the filter media 26, as shown in FIG. 3, and rise within the filter media 26 beyond the height of the initial dispense level. In a period of approximately 5 minutes all of the PTFE colloidal suspension liquid 12 is absorbed into the filter media 26 less a thin film on the filter center tube 18 and retainer 16. This allows almost the entire amount of PTFE colloidal suspension to be retained within the filter media 26. A less preferred method to saturate the filter media 26 would be to dispense the colloidal suspension on the filter media 26 during other stages of the filter 10 manufacturing process. A suitable filter media 26 for practicing this invention is used in AlliedSignal's FRAM Extra Guard oil filter.

[0013] A suitable PTFE colloidal suspension is SLA-1612 supplied by Acheson Colloids Company. Acheson SLA-1612 contains a 20% solids content of PTFE in a 150 solvent neutral petroleum oil with a dispersing agent. It has a viscosity of 400 cP at 25 °C. The size of the PTFE particles suspended in the oil is less than 2 micrometers in diameter. A stable colloidal suspension such as Acheson SLA-1612 is very suitable for practicing this invention. The size of the PTFE particles are considerably smaller than the pore sizes of the filter media 26 thus they will not become trapped by the filter media 26 when flow is initiated in the engine lubricating system. Also, the PTFE colloidal suspension remains well dispersed so that the less than 2 micrometer PTFE particles will not agglomerate and become too large and not be able to readily pass through the filter media 26. Additionally the viscosity of the Acheson SLA-1612 liquid is ideal for the capillary action to occur within the filter media 26 allowing the liquid to be completely absorbed within the media pore structure.

[0014] The PTFE colloidal suspension 12 can be formulated with a surfactant/coupling agent which promotes bonding of the PTFE to the engine metal surfaces. Also, additives can be utilized to aid in maintaining the PTFE dispersion. Other anti-wear additives can be retained in the filter media intricacies and delivered to the engine lubrication system by the method described in this invention. These additives can be in the form of a colloidal suspension or in solution with a carrier oil. Examples of other anti-wear additives but not inclusive are molybdenum disulfide and graphite. As described above the colloidal dispersion of PTFE in oil when disposed in contact with the filter media 26 wicks into the filter media 26 providing a means to retain the colloidal dispersion 12 within the intricacies of the media fibers. The PTFE colloidal dispersion is completely and immediately released into the engine lubricating system when oil flows during first engine start up after the filter 10 is installed.

Claims

1. An oil filter for an engine lubricating system comprising

   an inlet port;
   an outlet port; and
   a filter media formed from a plurality of fibers disposed between said inlet port and said outlet port containing a mixture comprising PTFE particles less than 2 micrometers in size and petroleum product, characterised in that said mixture is a colloidal suspension retained by capillary forces within the intricacies of the filter media fibers.

2. An oil filter for an engine lubricating system as claimed in claim 1 wherein:
   the PTFE colloidal suspension is released into the engine lubricating system during the first engine start up after the engine oil filter is installed.

3. An oil filter for an engine lubricating system as claimed in claim 1 wherein molybdenum disulfide is disposed in the filter media fibers.

4. An oil filter for an engine lubricating system as claimed in claim 1 wherein graphite is disposed in the filter media fibers.

5. A method for introducing PTFE into a spin-on oil filter having a filter media formed from a plurality of fibers disposed between an inlet and an outlet comprising the steps of:

   a) positioning the oil filter in a generally upright position with the outlet at the top;
   b) introducing a quantity of a colloidal suspension of PTFE particles less than 2 microns in size suspended in a petroleum product into the outlet; and
   c) waiting a period of time for substantially all of the quantity of the PTFE colloidal suspension to be drawn by capillary forces within the intricacies of the filter media fibers.

6. A method of introducing PTFE into a spin-on oil filter having an inlet and an outlet on the same end with a filter media formed from a plurality of fibers disposed between the inlet and the outlet comprising the steps of:

   a) aligning the filter with the inlet and the outlet in a generally upright position;
   b) introducing a colloidal suspension containing PTFE particles of less than 2 micrometers in size into the filter in contact with the filter media; and
   c) waiting a period of time until almost the entire amount of the colloidal suspension containing PTFE particles is drawn into the voids between the filter media fibers.

7. A method as claimed in claim 6 wherein the colloidal suspension of PTFE particles is introduced through the outlet.

8. A method as claimed in claim 6 wherein other anti-wear additives are introduced along with the PTFE particles into the spin on oil filter.

Patentansprüche

1. Ölfilter für ein Motorschmiersystem mit

   einer Einlaßöffnung;
   einer Auslaßöffnung und
   einem aus mehreren Fasern gebildeten, zwischen der Einlaßöffnung und der Auslaßöffung angeordneten Filtermedium, das ein Gemisch aus PTFE-Teilchen mit einer Größe von weniger als 2 Mikrometer und Erdölprodukt enthält, dadurch gekennzeichnet, daß es sich bei dem Gemisch um eine kolloidale Suspension handelt, die im Inneren der Filtermediumsfasern durch Kapillarkräfte zurückgehalten wird.

2. Ölfilter für ein Motorschmiersystem nach Anspruch 1, bei dem die kolloidale PTFE-Suspension beim ersten Starten des Motors nach dem Einbau des Motorölfilters in das Motorschmiersystem abgegeben wird.

3. Ölfilter für ein Motorschmiersystem nach Anspruch 1, bei dem in den Fasern des Filtermediums Molybdändisulfid angeordnet ist.

4. Ölfilter für ein Motorschmiersystem nach Anspruch 1, bei dem in den Fasern des Filtermediums Graphit angeordnet ist.

5. Verfahren zum Einbringen von PTFE in einen Spin-On-Ölfilter mit einem zwischen einem Einlaß und einem Auslaß angeordneten, aus mehreren Fasern gebildeten Filtermedium, bei dem man

   a) den Ölfilter in einer generell aufrechten Position mit dem Auslaß an der Oberseite positioniert;
   b) in den Auslaß eine Menge einer kolloidalen Suspension mit PTFE-Teilchen mit einer Größe von weniger als 2 Mikrometer in einem Erdölprodukt einbringt und
   c) eine Zeitlang wartet, damit die Menge der kolloidalen PTFE-Suspension durch Kapillar-

kräfte im wesentlichen vollständig in das Innere der Filtermediumsfasern hineingezogen wird.

6. Verfahren zum Einbringen von PTFE in einen Spin-On-Ölfilter mit einem Einlaß und einem Auslaß am selben Ende, wobei ein aus mehreren Fasern gebildetes Filtermedium zwischen dem Einlaß und dem Auslaß angeordnet ist, bei dem man

a) den Filter mit dem Einlaß und dem Auslaß in einer generell aufrechten Position ausrichtet;
b) in den Filter eine kolloidale Suspension mit PTFE-Teilchen mit einer Größe von weniger als 2 Mikrometer so einbringt, daß sie mit dem Filtermedium in Berührung kommt, und
c) eine Zeitlang wartet, bis praktisch die gesamte Menge der PTFE-Teilchen enthaltenden kolloidalen Suspension in die Hohlräume zwischen den Fasern des Filtermediums hineingezogen ist.

7. Verfahren nach Anspruch 6, bei dem man die kolloidale Suspension von PTFE-Teilchen über den Auslaß einbringt.

8. Verfahren nach Anspruch 6, bei dem man in den Spin-On-Ölfilter neben den PTFE-Teilchen auch noch andere Verschleißschutzadditive einbringt.

Revendications

1. Filtre à huile pour un système de lubrification de moteur, comprenant :

un orifice d'entrée,
un orifice de sortie, et
un support filtrant formé d'une pluralité de fibres disposées entre ledit orifice d'entrée et ledit orifice de sortie contenant un mélange comprenant des particules de PTFE d'une taille inférieure à 2 micromètres et un produit de pétrole, caractérisé en ce que ledit mélange est une suspension colloïdale retenue par des forces capillaires dans les enchevêtrements des fibres du support filtrant.

2. Filtre à huile pour un système de lubrification de moteur selon la revendication 1, dans lequel la suspension colloïdale de PTFE est libérée dans le système de lubrification de moteur au cours du premier démarrage de moteur après l'installation du filtre à huile de moteur.

3. Filtre à huile pour un système de lubrification de moteur selon la revendication 1, dans lequel du disulfure de molybdène est disposé dans les fibres du support filtrant.

4. Filtre à huile pour un système de lubrification de moteur selon la revendication 1, dans lequel du graphite est disposé dans les fibres du support filtrant.

5. Procédé d'introduction de PTFE dans un filtre à huile à rotation qui a un support filtrant, formé d'une pluralité de fibres, disposé entre une entrée et une sortie, comprenant les étapes consistant :

a) à positionner le filtre à huile dans une position généralement droite avec la sortie au sommet,
b) à introduire une quantité d'une suspension colloïdale de particules de PTFE d'une taille inférieure à 2 micromètres en suspension dans un produit de pétrole dans la sortie, et
c) à attendre pendant une certaine période de temps que sensiblement toute la quantité de la suspension colloïdale de PTFE soit aspirée par des forces capillaires dans les enchevêtrements des fibres du support filtrant.

6. Procédé d'introduction de PTFE dans un filtre à huile à rotation qui a une entrée et une sortie à la même extrémité, un support filtrant formé d'une pluralité de fibres étant disposé entre l'entrée et la sortie, comprenant les étapes consistant :

a) à aligner le filtre avec l'entrée et la sortie dans une position généralement droite,
b) à introduire une suspension colloïdale contenant des particules de PTFE d'une taille inférieure à 2 micromètres dans le filtre en contact avec le support filtrant, et
c) à attendre pendant une certaine période de temps que presque toute la quantité de la suspension colloïdale contenant des particules de PTFE soit aspirée dans les vides entre les fibres du support filtrant.

7. Procédé selon la revendication 6, dans lequel la suspension colloïdale de particules de PTFE est introduite par la sortie.

8. Procédé selon la revendication 6, dans lequel d'autres additifs anti-usure sont introduits avec les particules de PTFE dans le filtre à huile à rotation.

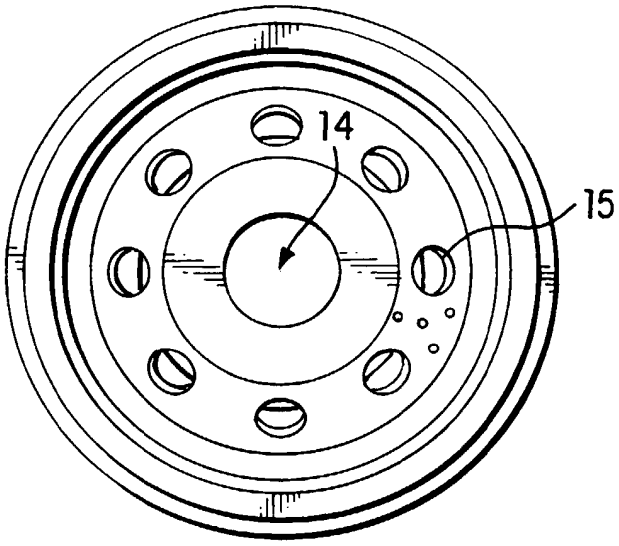

FIG. 2

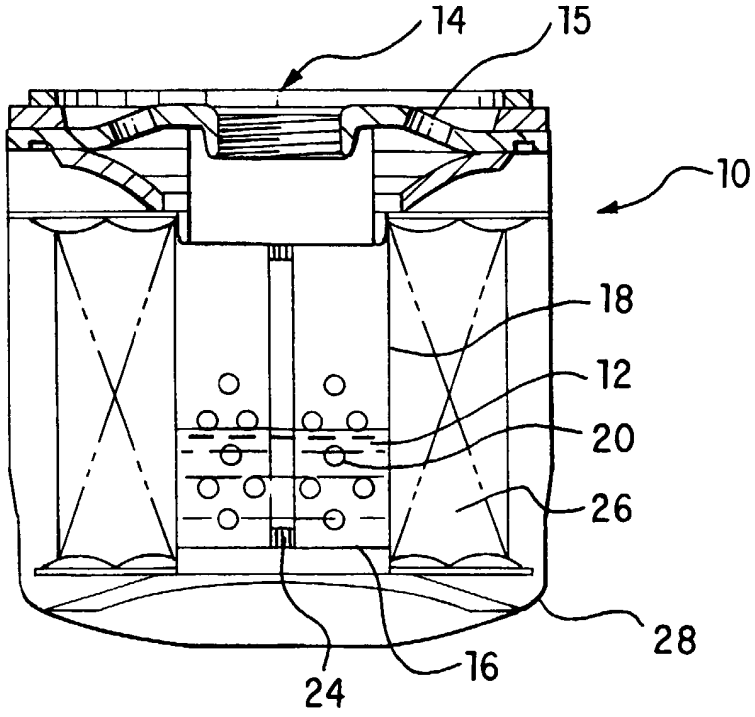

FIG. 1

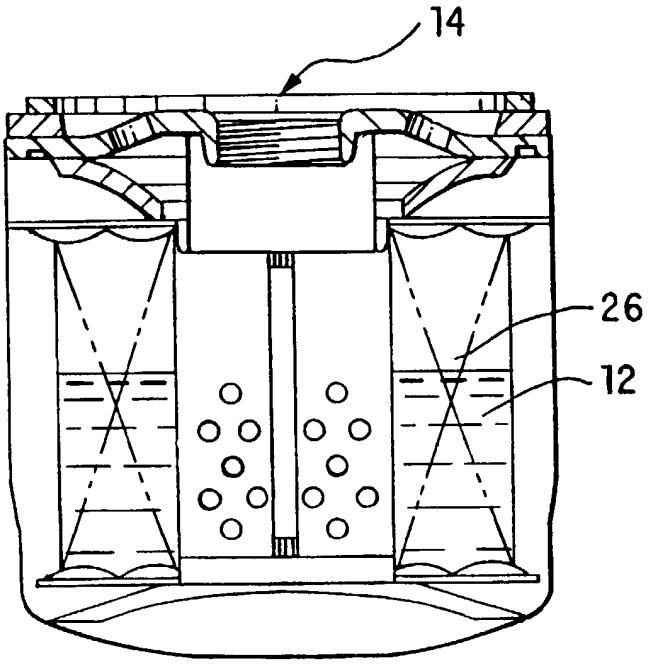

FIG. 3

FIG.4